Amendments to the Specification

Please replace paragraph **[0001]** with the following rewritten paragraph:

[0001] This non-provisional application claims the benefit of ~~U.S. Provisional~~ U.S. Provisional Application No. ~~_____~~ 60/270,173 entitled "Constant Envelope Forcing Algorithm Using Correlation-Based Attenuation For Digital Pre-Distortion" which was filed on February 22, 2001, and is hereby incorporated by reference in its entirety. The Applicant of the provisional application is Michael Pilcher.

Please replace paragraph **[0002]** with the following rewritten paragraph:

[0002] This invention relates to constant ~~envelop~~ envelope for output signals.

Please replace paragraph **[0003]** with the following rewritten paragraph:

[0003] Linearity may be a critical parameter in power amplifiers and mixers. For example, class A power amplifiers are used in communications systems because they are highly linear. Many manufacturers incorporate additional feed-forward paths to achieve linearity in power amplifiers. However, due to possible peaks in signal values, linearity in components such as power amplifiers can be obtained only if requirements of resources such as power supply voltages are maintained at a sufficiently high level to account for the signal peaks. Thus, the signal peaks force higher resource requirements which ~~results~~ result in higher equipment costs. Accordingly, there is a need for new technology that can reduce resource requirements in components like power amplifiers and mixers without linearity degradation.

Please replace paragraph **[0004]** with the following rewritten paragraph:

[0004] An apparatus and method is provided for controlling an ~~envelop~~ envelope of combined signals to within a prescribed limit. When multiple input signals are combined into a single output signal for transmission, for example, various ones of the input signals may be correlated for short time intervals causing signal power peaks. The peaks in the combined

signal may be controlled by attenuating (pre-distorting) contributing input signals. All the input signals are combined to form a first summary signal. A similarity measurement is made between each of the input signals and the first summary signal, and an attenuation value for each input signal is generated based on the similarity measurement. The input signals are then attenuated by corresponding attenuation values prior to combining the input signals into a second combined signal for output. In this way, the magnitude of the peaks in the second combined signal are reduced to within the ~~envelop,~~ envelope, thus permitting lower component resource requirements.

Please replace paragraph **[0005]** with the following rewritten paragraph:

[0005] This invention is described in detail with regard to the following figures, in which like elements are referred to with like numerals, and in which:

Fig. 1 is an exemplary block diagram ~~of a~~ of one system where multiple input signals are combined into a single output signal for transmission;

Fig. 2 is an exemplary block diagram of a local access provider (LAP) combining input signals of end-users into a single output signal for transmission;

Fig. 3 is an exemplary block diagram of the LAP that includes a pre-distortion device;

Fig. 4 is a detailed exemplary block diagram of a pre-distortion device;

Fig. 5 is an exemplary block diagram of an attenuator controller;

Fig. 6 is an exemplary signal diagram of various input signals received by the pre-distortion device of Fig. 4;

Fig. 7 is an exemplary signal diagram of a base-band input signal;

Fig. 8 is an exemplary expanded signal diagram of data for the input signals of Fig. 6;

Fig. 9 is a detailed exemplary diagram of a portion of the signals shown in Fig. 8 divided into windows;

Fig. 10 is an exemplary diagram of a magnified portion of signals shown in Fig. 9 and the combined signal;

Fig. 11 is an exemplary block diagram of components that implement the pre-distortion device; and

Fig. 12 is an exemplary flow chart of a process of the pre-distortion device.

Please replace paragraph **[0007]** with the following rewritten paragraph:

[0007] The peaks in the combined signal may be reduced by attenuating amplitudes of the input signals. Input signals that contribute to the peaks may be selected by measuring a similarity (e.g., cross correlation) between each of the input signals and the combined signal. When the similarity measurement of an input signal exceeds a threshold, for example, an attenuation value for the input signal may be generated based on the results of the similarity measurement. By attenuating the amplitudes of all the input signals whose similarity measurement exceeds the threshold, the peaks in the combined signal may be reduced to within a predetermined value (e.g., an ~~envelop).~~ envelope). The attenuated input signals may then be combined with the other non-attenuated input signals to form a new combined signal that fits within the desired ~~envelop.~~ envelope. Thus, a dynamic range requirement on the components that process the new combined signal is reduced to be less than that required to process the original combined signal, which, in turn, results in a reduction of requirements on other supporting devices such as power supplies, etc.

Please replace paragraph **[0012]** with the following rewritten paragraph:

[0012] Fig. 3 shows a portion of the LAP 106 that combines the communication signals received from the links 120-124. The received communication signals may be each modulated by modulators 216-220 to respective intermediate frequency (IF) carriers, for example. The modulated IF carriers are input to a signal pre-distortion device 200 via links 222-226. The signal pre-distortion device 200 outputs attenuated modulated IF carriers via

links 202-206 to a combiner 208 to generate a combined signal. The combined signal may then be up-converted by an up-converter 210 and amplified by a power amplifier 214 before output via link 130 for transmission, for example. The signal pre-distortion device 200 forces the combined signal output by the combiner 208 to be within a constant ~~envelop~~ envelope by attenuating selected ones of the modulated IF carriers input via the links 222-226.

Please replace paragraph **[0015]** with the following rewritten paragraph:

[0015] One of the purposes of the combiner 402 is to generate the second combined signal that predicts one or more time intervals where the first combined signal may exceed a predetermined value. The predetermined value represents the constant ~~envelop~~ envelope (i.e., a maximum not to exceed value). Once the time intervals are identified, the input signals are processed by the similarity measurement devices 406-410 to generate a comparison value for each of the input signals. The comparison values are used by attenuation value generators 418-422 together with an input selection parameter generated by an input selection parameter generator 430 to select ones of the input signals that are most likely contributors to peaks in the first combined signal. A controller 432 may also be included to coordinate the processes of the attenuator controller 332.

Please replace paragraph **[0024]** with the following rewritten paragraph:

[0024] The peaks in the combined signals 458 may be detected by using thresholds such as a threshold 460. The threshold 460 may represent an ~~envelop~~ envelope within which the combined signal 458 must be contained in order to guarantee faithful processing by down stream devices such as the power amplifier 214, for example. Thus, if the amplitude of the combined signal 458 exceeds the threshold 460, then the pre-distortion device 400 attenuates select ones of the input signals 450-454 to reduce the amplitude of the combined signal 458 to be less than the threshold 460 (i.e., to within the ~~envelop).~~ envelope).

Please replace paragraph **[0029]** with the following rewritten paragraph:

[0029] For example, a dot-product between each of the input signals 450-454 and the second combined signal may be used to generate a "windowed" cross-correlation. As is well known, a cross-correlation between two waveforms is generated by integrating the two waveforms as one waveform is "swept" pass the other waveform. For discrete waveforms, as the case here, the sweeping corresponds to concatenating in time the windows of data corresponding to one of the input signals 450-454 and the second combined signal, and moving one window of data past the other in one sample time increments. The integration corresponds to taking the dot products of any overlapping samples and summing the results. The dot product is the product of the overlapping samples. Alternatively, a windowed dot-product can also be used. A single window of some number of samples could be swept over both the individual signal and the combined signal. The output may be the integral of the ~~product~~ product.

Please replace paragraph **[0030]** with the following rewritten paragraph:

[0030] The outputs of the similarity measurement devices 406-410 may be compared to a predetermined selection threshold value by the associated attenuation value generator 418-422. Those input signals 450-454 that exceed the predetermined selection threshold may be attenuated by a preset amount so that the combined signal generated by the combiner 208 is guaranteed to be within the desired ~~envelop.~~ envelope.

Please replace paragraph **[0033]** with the following rewritten paragraph:

[0033] N may be determined statistically or experimentally based on the number of input signals 450-454 that needs to be reduced when a peak occurs to force the combined signal to fit within the desired ~~envelop.~~ envelope. For example, if it is determined over a representative period of time that attenuating each of 10 input signals 450-454 by 8% is sufficient to achieve satisfactory performance, then N = 10 and M = 8%. M may be made

different for each of the input signals 450-454. For example, M may be based on the degree of similarity between a particular input signal 450-454 and the second combined signal.